Novel EM Signal Filtration Mechanism – Precision Transflector Ranging and Timing for Phase-Predictable Receipt of Signal in Nested Spheres

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Introduction

The current industry standard for RF filtering for applications such as cellular telephone traffic is what is known as a Thin-Film Bulk Acoustic Resonator (TFBAR.) This technology has a number of limitations. The frequencies which can be handled by TFBAR are limited by the ability to etch resonator "teeth" with increasing proximity to one-another. However, there are other problems with this system.

Fundamentally, this is a signal filtration mechanism which is based upon eliminating all frequencies except for the desired range of frequencies through a process of acoustic resonance. All frequencies outside of the desired range are converted into acoustic energy through a piezo-electric process. This requires that the filter sit in an atmospheric vacuum. The signals used to carry cellular traffic are frequency-modulated within a specific range of frequencies assigned to a specific telephone according to which are available for use in a specific geographic area. Frequency modulation is traditionally accepted to be the best way to transmit large quantities of data with minimal noise. Amplitude can be easily distorted by signal reflections and is therefore not used in high-bandwidth applications.

Interestingly, in fiber-optics, only a single frequency of light is used to carry data, although, over the years, efforts have been made to explore the feasibility of carrying data over more than one frequency concurrently. Nevertheless, fiber-optic signals are pulse-modulated as this produces the lowest possible degree of noise in the signal.

The following proposal represents a fundamentally novel approach to EM filtering which dispenses with the TFBAR paradigm and which would call for cellular traffic to be governed by a system of pulse-modulation at a single, exquisitely pure frequency for each receiver node whereas a single cellular telephone might incorporate a number of these nodes. The proposal would reduce filter costs (mostly by obviating the need for the filter to sit in an atmospheric vacuum) increase effective bandwidth, decrease the power required for transmission by a handset to near-zero (ibid. previous publication on signal transflectors,) allow for filtering at extremely high frequencies and, most importantly, allow for band-passes of exacting precision not possible with TFBAR.

Abstract

The following is a description of what might be termed a *Nested Sphere Frequency Filtering by Signal Transflectance Receiver Ranging* mechanism (NSFF-STRR.)

This mechanism would consist of a series of atomically-thin receivers of a spherical shape each of which are nested within an outer sphere consisting of a transflector (ibid. 10 June 2025.) For reference, a *transflector* is a mechanism which is capable of retro-reflecting a microwave-domain signal back to the source selectively sc. only when electrified. This property of transflectance allows for all of the following: The transmission of signal without the use of any energy beyond that used to electrify the shell, the measurement of range to the receiver by the cellular tower (critically important for this application) and the gating of signal according to an agreed-upon timing negotiated with the transmitter.

The inner of the two nested layers would be situated at a predictable distance from the outer layer so that, through the use of miniaturized precision clocks in both the receiver and the transmitter, the precise phase position of received waves may be anticipated to be at a “crest” or “trough” at the time when they strike the detector. It is at this position that a wave of electromagnetism can be reliably converted into an electrical signal. The distance between the transmitter and the outer shell would be used to calibrate the timing of the signals so that, in addition to the electrification of the EM-transflecting layer at all times except for the time at which a potential “zero” or “one” could be expected to be received (any radio signals outside of the expected times can be entirely blocked.)

Any electromagnetism which makes it through the outer gating mechanism which is not part of the intended signal could be filtered by ensuring that the detector will only convert photonic energy at a crest or trough in phase (this tends to be the natural way photovoltaic materials work.) For the transmitter, this is like trying to hit a moving target in more ways than one.

If the transmitter is sending signals according to a specific, agreed-upon timing and the other shell of each sphere is electrified (and thus blocking signals) at all times except for the time that a proper signal can be expected, noise is immediately reduced to a great degree, however, the phase-selectivity of the inner sphere is an essential ingredient fo eliminating the remainder of the noise.

For this to work, as alluded to, the precise distance between the transmitter and the receiver to within a margin of several angstrom must be known. As the receiver would likely not be absolutely positionally stable (due to vibrations and the fact that the users of these devices are usually walking or driving as they use them.) Because the blocking layer is not merely blocking the non-data signals but is reflecting them, this means that a new range measurement can be taken at an exceptionally high iterative rate. The incorporation of OASICs in the handsets and at the cellular towers is far from the greatest technical challenge in this case.

Relative range between the transmitter and receiver would have to be anticipated using trigonometric functions and a substantial amount of processing power. The system would need to be able to anticipate the precise position of the receiver at the expected time of receipt of the next bit, using the real position at the time of the receipt of the previous three bits in order to make an accurate projection. That projection must then be converted into a

computational instruction which reflexively governs the starting phase of the signal at the scheduled time of transmission. By tailoring the phase at the time of transmission (which is conducted according to a previously agreed-upon schedule,) the phase position at the time receipt can be controlled sufficiently so as to ensure that the intended signal will be at a peak or trough in phase at the instant that it strikes the (inner) detector-sphere. Any signal not at a peak or trough which somehow makes it through the transflector layer would be treated as noise and ignored (it literally would not be converted into an electron at all.) It would be extremely unlikely that electromagnetic energy conforming to these exacting timing and phase parameters which were not part of the intended signal would make it to the signal processor.

Another technical challenge would be finding a material which would support sufficiently rapid switching of the transflectance property. Applying alternating voltage is a relatively straightforward proposition, but the ephemerality of charge of the material would need to be particularly high (similar to that of semiconductors used in data processing, if not greater.)

Because this approach does nothing to dampen the amplitude of received signals, the transmission of data using signals of lower amplitude should be possible. Quite different from a resonator mechanism, this system works on the basis of a shutter mechanism coupled with an antenna which acts as a secondary shutter by detecting/converting only photons of near-zero magnetic moment (associated with peaks and troughs in phase.)

Assuming an operational frequency of 300 GHz, each sphere would need to be at least 25 microns in size, but each sphere would be capable of transmitting and receiving data, necessarily, at a rate of 300 billion bits per second. It is important to note that the small size of the transflector would necessarily mean that the amplitude of the return signal (used both for ranging/calibration and for transmission of data back to the tower) would be logarithmically lesser than that of the transmitted signal the more one attempts to miniaturize the antennae. There is little practical reason for the spheres to be only microns in size as, in a properly calibrated system, only one sphere would be needed to support impressive data transfer rates. By purposefully making the spheres somewhat larger (visible to the naked eye,) this would allow for a sufficient amount of energy to be retro-reflected in order for the detectors at the cellular tower to make use of them. It would also be helpful if the retro-reflective layer were as close as possible to being flat relative to the EM striking it. If it is too parabolic, this will only serve to both diffuse and diffract the signal. If it is too small, not enough energy would be returned to the tower. In any event, spheres must be utilized because there is no way to know at what angle someone will be holding their telephone relative to the tower and this value is subject to constant change. Counter-intuitively, in an age of increasingly miniaturized electronic components, this antenna should as large as possible. In fact, this should be intuitive as it has always been the case that larger antennae have always been more effective at carrying out their intended purpose.

It could be anticipated that packets may be dropped by the system both due to interference which makes it through the mechanism and due to inaccuracies

in the system for maintaining phase synchronization with the *phase-sensitive antenna*. The phase-sensitive antenna is little more than a photovoltaic optimized for the microwave domain.

In order to make the system more fault-tolerant, multiple phase-sensitive layers can be added both above and below the target-layer. Those layers could collect secondary data-sets and, in the event of a dropped packet, lost packets could be found in the “takes” from the neighboring layers collecting data concerning phase-offset signals. Those “alternative bits” could be plugged-in and tested by the receiver in order to see if their substitution successfully repairs the packet. This would remove some of the burden from the trigonometric computers at the cell tower and allow for some margin of error in the phase-calibration aspect of this mode of data transmission.

Conclusion

This fundamentally revolutionary approach would allow for individual links between cellular towers to consume comparatively small portions of the electromagnetic spectrum. The range of frequencies allocated for each link would be something like 1200 Hertz between 300.000.000.000 and 300.000.001.200 Hertz.

Transmission of outgoing signals would necessarily be based upon the reflectance of frequency of a secondary carrier frequency constantly emitted by the tower. In this way, the spherical retro-reflector would be able to broadcast (as explored in the June publication) with the aid of the carrier, on a wide-range of possible frequencies which are determined by the cellular tower. Transmissions would be handled by a secondary spherical retro-reflector separate from the receiving antenna in which the sphere, unlike in the receiver, spends most of its time *not* being in an electrically-charged state. Only when one wishes to transmit data would this transmitting antenna be electrified. The receiving antenna/filtering mechanism described would spend the preponderance of its time being electrically charged so as to filter undesired EM noise and to provide feedback to the tower concerning distance necessary to the mode of operation of the mechanism.